2.2 Secondary Succession

Figure D2.9: Helicopters often play major roles in dousing forest fires.

A helicopter with a cargo of brave firefighters circles close to a blazing forest fire. The inferno has been burning for weeks in the unusually hot spring weather, and no rain is forecast for many days. Nearby homes have had to be evacuated. The cause of the fire is uncertain—perhaps it was lightning or careless campers. Thousands of hectares of thick coniferous forest have been charred, which means valuable timber and animal habitat have been destroyed. A forest fire is an awesome destructive force.

Recall your work with biogeochemical cycles in Chapter 1. If you visited the blaze site even just a few months later, you should not be surprised to see lush, green shoots in the blackened ground. You might see deer and other herbivores taking advantage of the soil's higher nitrogen content by grazing on the tender new vegetation. Since the soil was not removed, the process of succession in a burned-out area proceeds much more quickly.

In the following year the area would continue its rapid change and you might find yourself standing in a grassy meadow with bright purple fireweed growing as tall as your waist and lodgepole pine seedlings just beginning to poke their way through the ground. In this meadow, only a few blackened poles would serve as a reminder of the inferno. A forest fire can be both destructive and regenerative.

Figure D2.10: Succession in a burned-out area is highlighted.

The progression to a climax community after a disturbance that does not remove the soil is called **secondary succession**. If the soil has not been removed, the area can often be quickly colonized by plants that are more complex than lichens and mosses. Secondary succession occurs quickly in the freshly tilled soil of a garden. If not maintained, the garden will soon be overrun with grasses and weeds that grow quickly in the soil. Soil presence makes a secondary succession process much faster than a primary succession process, but the end result is the same: the development of a climax community.

secondary succession: the return in stages to a stable climax community from an area that has had its vegetation—but not its soil—removed

Investigation

Observing Primary and Secondary Succession

Science Skills

✓ Performing and Recording
✓ Analyzing and Interpreting

Purpose

You will find evidence of succession in and around your local area.

Procedure

step 1: Take a walk around your school grounds, around a parking lot, around the block, or to a nearby park or forest. Your teacher may have a route planned for you or may assign the first two steps of this procedure for homework.

step 2: While you walk, look for any examples of primary and secondary succession. This could include plants growing through cracks in the sidewalk, an empty lot overgrown with weeds, or mosses and lichens growing on objects. Create a map of your walk, and record where you observed the different types or stages of succession. You may want to make more detailed sketches from the different succession evidence you find.

step 3: Share with your classmates an example of primary succession and one of secondary succession that you observed on the field study.

Analysis

1. Using examples from your walk, explain what impact people have on the process of succession in your community.
2. List at least three possible ways that you directly affect the succession process in your community.
3. Describe any collected evidence that demonstrates succession directly occurring on houses or buildings observed on your walk.

Extension

4. Picture an area of lawn on the school grounds. Can you find any examples of succession there now? How would the lawn look different if it were not maintained for five years? How about after 10, 50, and 100 years?

Use the following information to answer questions 5 and 6.

This temple in Figure D2.11 was part of a great Mayan city found in present-day Central America. It is estimated that thousands of people lived in the city more than 1000 years ago. This site would have been considered sacred by those people.

Figure D2.11: At one time, thousands of people lived around this Mayan temple.

5. a. Infer some of the things that the Mayans would have done to the site around the temple to support such a large city.
   b. How has the process of succession changed what the Mayans did to the area?
6. Prepare a representation of what your community would look like if it was abandoned for several hundred years and natural succession was allowed to take place. You can present your project as a poster, diorama, model, computer presentation, or some other suitable form.

Secondary Succession in National Parks

For most of the last 100 years, forest fires have been strictly controlled in most of Alberta's provincial parks and Canada's national parks. Forest fires caused by lightning strikes, by sparks from passing trains, or by humans were quickly put out to preserve the climax communities of these parks. As a result of human intervention, the climax community of conifers expanded to take over the parks to a greater degree than might naturally be found. The density of thick tree growth provided even more fuel available to be burned—this resulted in more massive and dangerous fires. Larger areas of coniferous forests also meant that grazing deer and elk had fewer grassy meadows to feed in. A number of animal species in parks were inadvertently threatened because of policies that were designed to preserve the majestic habitat.

Figure D2.12: The climax communities of conifers have expanded in Canada's national parks.

Researchers have found that First Nations people living in the area practised controlled burning of forests. They did this to promote the growth of meadows for medicinal plants and berries, and for vegetation to attract deer and elk so they could hunt these animals. An analysis of tree rings from these traditional areas shows regular burn scars. The burn scars observed occurred during wet months when natural fires were unlikely to have ignited by natural means. This evidence has led researchers to hypothesize that these people encouraged these blazes.

Figure D2.13: Prescribed burns have been used to maintain plant and animal diversity.

Park officials have discovered that to maintain plant and animal diversity, they could manage the forest ecosystem by mimicking practices similar to those of First Nations people who helped shape the park ecosystem. For example, human-made fires—prescribed burns—have become a practice in Elk Island National Park. Controlled burns have been used to benefit the park's elk and bison populations by creating new grazing areas.

Practice

Use Figure D2.14 to answer the following questions about the town of Banff and Banff National Park.

1. Where are the open areas that would be good for grazing elk and deer? What problems can you predict might occur in Banff due to a lack of wild meadows for grazing elk and deer?
2. Given that thick evergreens grow right up to the edge of town, how would the community of Banff be affected if a large, uncontrolled fire broke out in Banff National Park?

Figure D2.14: Banff townsite and its surrounding area is highlighted.

Forest Harvesting Practices in Alberta

Alberta's forests are an extremely important resource. The forest industry creates jobs and essential products that range from lumber for building homes to the paper and pencils you take notes with. Alberta's forest industry is responsible for the generation of about $8 billion each year.

When trees are harvested, companies are required by law to participate in reforestation programs within two years of harvesting the trees. Many ecologists argue that some reforestation practices interfere with naturally occurring secondary succession because replanted trees lack the biodiversity of the natural forest.

You can learn about forest harvesting practices in Alberta in the next activity.

Figure D2.15: Alberta's forest industry is worth about $8 billion annually.

Utilizing Technology

Forest Harvesting

Purpose

You will use the applet called "Forest Harvesting" on the Science 20 Textbook CD to investigate different methods of harvesting trees from Alberta's forests.

Science Skills

- ✓ Performing and Recording
- ✓ Analyzing and Interpreting

Procedure

step 1: Copy a large, full-page version of the following summary table into your notebook.

step 2: Use "Forest Harvesting" to complete the table by recording point-form notes under each heading after watching the applet.

Forest Harvesting Method	Description of Method	Advantages of Method	Disadvantages of Method
selection cut			
clearcutting			
shelterwood cut			
seed tree cut			

Analysis

1. Determine which method of forest harvesting causes the least damage in terms of habitat fragmentation and habitat destruction.
2. Determine which method of forest harvesting causes the most damage in terms of habitat fragmentation and habitat destruction.

Sustainable Development

There is a debate within the province of Alberta regarding techniques of harvesting forests. At issue is whether these techniques balance economic progress with the need for environmental protection and stability. Many environmentalists would say that some harvesting techniques, such as clearcutting, are not following the principles of **sustainable development**.

sustainable development: development that meets the needs of the present without compromising the needs of future generations

Representatives of the forest-products industry claim that in stands of trees like lodgepole pines, clearcutting is a sound practice because lodgepoles need light and disturbed soil to regenerate a new forest.

As you dicovered in Chapter 1, differences between ecological and economic systems are the sources of many disputes over land use in Alberta. Few topics can spark as much debate between the groups of people supporting each of these systems as clearcutting. In the next set of questions you will explore this issue from several points of view and research the latest findings on this topic.

Practice

3. Consider the following list of stakeholders. Concisely describe the point of view that each stakeholder might have about the practice of clearcutting in an area close to where the stakeholder lives.
   a. a logging company truck driver
   b. an environmental protection group
   c. a pulp and paper mill owner
   d. a First Peoples group
   e. a supporter of the deer population
4. Use the Internet or other resources to research forestry practices in Alberta and to answer the following questions.
   a. Describe the climax community in Alberta's boreal forests.
   b. A volume of new growth is added to Alberta's forests every year. Meanwhile, another volume of Alberta's forests is harvested every year. Compare these values.
   c. Identify what circumstances make clearcutting a favourable option for the forest industry.
   d. Determine the number of jobs in Alberta dependent on the forest industry.
   e. How effective or desirable is the practice of replanting trees into clearcut areas?
   f. List some environmental effects of clearcutting.

Finding Common Ground

Many consumers are demanding forestry companies adopt policies that reflect sustainable development. This means that companies can only harvest amounts of wood that forests can provide on a long-term basis. This also means that companies conserve soil and water quality and protect wildlife habitat, as well as protect rare plants and animals.

To meet this need, many retailers are selling only wood products certified by the non-profit Forest Stewardship Council (FSC). Forestry companies that use extensive clearcutting techniques cannot become FSC certified. Other certification programs are being developed that address the ecological concerns of consumers. Many companies in the forest industry have embraced the notion of some kind of certification process because they are already practising sustainable development, and certification helps to make this information known to the public. Some people within the forest industry see certification as a competitive edge over non-certified competitors. It is also viewed as a genuine way to improve public relations with environmentally conscious

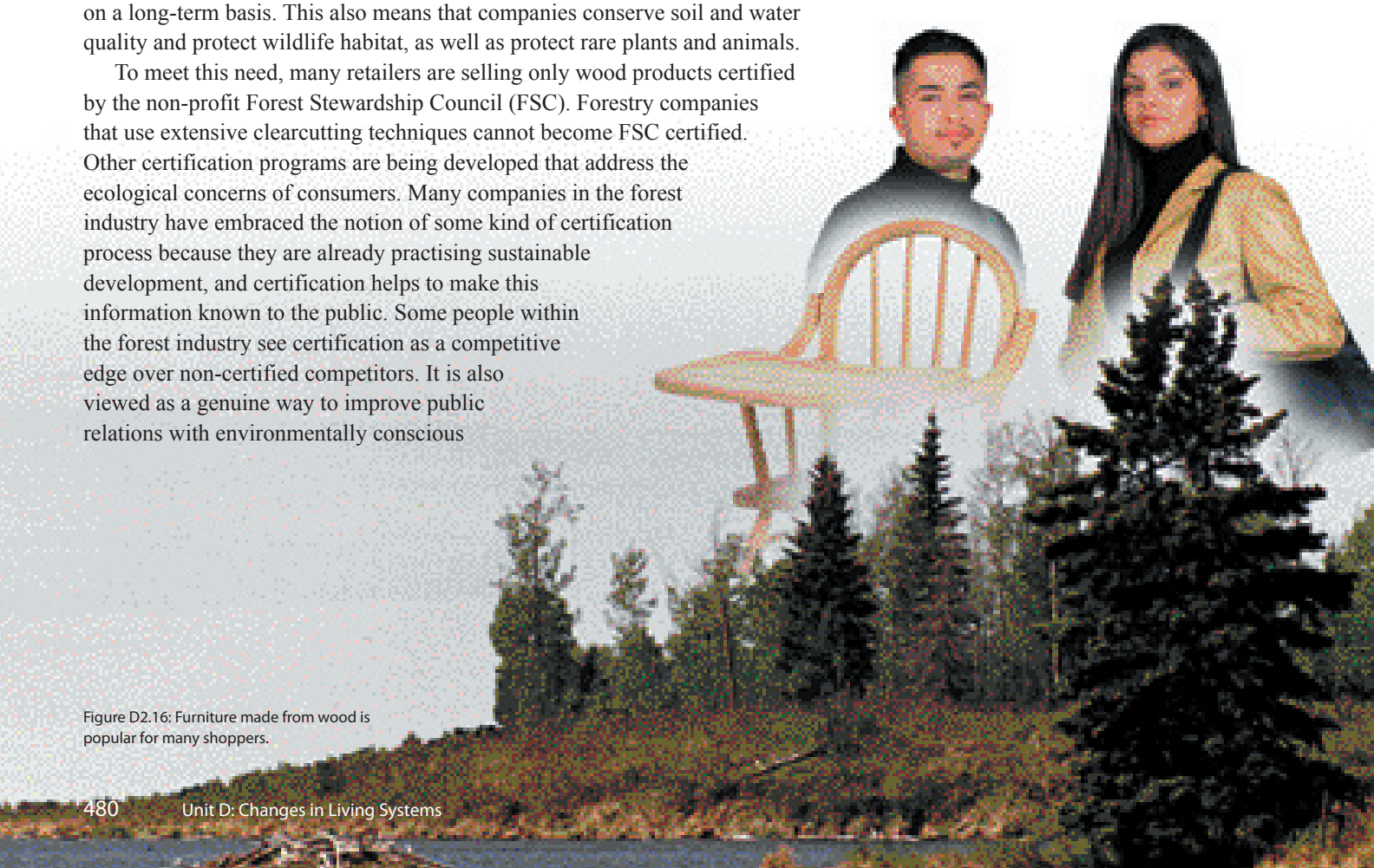

Figure D2.16: Furniture made from wood is popular for many shoppers.

Practice

5. In Chapter 1 you read that there are fundamental differences between the economic system and the ecological system. Concisely explain how initiatives like FSC certification attempt to build links between these two systems.
6. Suppose you are shopping for some new apartment furniture. You happen to notice that one retailer sells only furniture made from wood supplied by FSC-certified forestry companies.
   a. Rank the importance of the following factors when making your furniture purchase: price, selection, convenient location, and FSC certification.
   b. Suppose a majority of consumers start insisting that the wood products they purchase be FSC certified. Suggest how this might affect the forest industry.

Summarize Your Learning: Succession on Display

Use images from the Internet, from a camera, or from a sketch pad to develop a series of images that illustrate the different stages of succession in your area. Label each image with a description of the succession stage, and describe the dominant species shown in each stage. Create a portfolio or poster for a class display.

2.2 Summary

Secondary succession occurs where soil already exists and, therefore, is much faster than primary succession. In this case, species like lichens and mosses are not required to create soil, so secondary succession on land begins with grasses and broad-leaved plants. In northern Alberta the end result of both primary and secondary succession is a stable climax forest, whereas in southeastern Alberta, the climax community is prairie grassland.

Any disturbance of an ecosystem can set in motion the process of secondary succession. In moderation, forest fires and other natural disturbances that begin secondary succession serve as means to promote species diversity in an ecosystem and regenerate ecosystems.

2.2 Questions

Knowledge

1. The results of primary succession and secondary succession are the same—both result in the development of a climax community. Why is secondary succession a faster process than primary succession?

2. Other than forest fires and logging, list at least three other disturbances that could cause secondary succession to begin. Explain how each of these disturbances could lead to secondary succession.

Applying Concepts

3. Many species of pine trees require intense heat from a fire so their cones will open fully and release the seeds inside. Explain how cones opening in response to intense heat provides some pine species with an advantage.

4. Monoculture is a term used to describe reforestation projects that replant a single species of desirable tree into logged, clearcut areas. Describe how reforestation projects change both species diversity and the direction of secondary succession.

5. Consider the following scenario. Eduardo accidentally spilled a litre of gasoline on his lawn while filling up his lawnmower. The affected grass turned yellow and died. Despite Eduardo adding fertilizers, raking away the dead grass, and planting new grass seed, in the following year only clover and dandelions grew in that spot. In terms of succession, explain what Eduardo has done.

6. In the Amazon rain forest, tree roots and other plants hold the thin soil in place. When a section of rain forest is clearcut, heavy rains wash away much of the topsoil. Using what you learned about the processes of primary and secondary succession, explain why—in terms of sustainability—deforestation is a topic of greater concern in a rain forest than it is in a boreal forest.